

THAYER (W.H.) & BAKER (J.E.)  
with Dr. Thayer's regards.

Report on Cholera to the Medi-  
cal Society of the County  
of Kings,

BY

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## REPORT ON CHOLERA.

### PART I.\*

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BROOKLYN.

CHOLERA EPIDEMICS.—Cholera is endemic in India, where it has existed for centuries, prevailing more or less all the time. In other parts of the world cholera exists mainly in great epidemics, having their starting-point in India during some virulent outbreak there.

The first great epidemic, it is said, began to spread from India in 1817, but did not reach Europe until 1829, arriving in England in 1831. The following year, 1832, in early spring, it landed at Quebec, then extending up the St. Lawrence by the great lakes to Chicago, and thence to other parts of the United States. This, the first epidemic, continued in different parts of the world, and finally disappeared about 1834, seventeen years after it first spread beyond the confines of India.

The second great epidemic, and the most fatal, began to extend from India about the year 1841, and reached England in 1848, and America, at New Orleans, in 1849, prevailing in different parts of the country for four or five years.

The third great epidemic began its march from India in

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April, 1865, reaching England July 10th, the same year, and America, May 1st, the following year, 1866, at New York.

A fourth epidemic of cholera commenced its westward course from India in 1883 and extended to Europe in June, 1884, and, unless its rate of travel is different from that of former epidemics, or unless it is kept back by sanitary science, it will surely complete its journey as in former epidemics.

Aside from the great interest in the probable visitation of cholera to this country, is that shown by the vigorous researches made bearing upon its ætiological relations by the leading scientific men of the day.

For these investigations men have been sent from different countries to the various cholera districts. The German Government has sent a commission, with Dr. Koch at its head. The English Government has sent a commission similar, with Dr. Klein as its leading spirit. The French Government, besides sending out a commission of its own men, has sent out two Swiss physicians under its direction.

Two of the ablest papers that have appeared recently in this country on the present status of the study of cholera were penned by Dr. Frank Hamilton and Dr. Flint, Sr. The latter may be fairly considered an exponent of the principles enunciated by Koch, while Dr. Hamilton represents a class who discredit the deductions of Koch, as might be inferred from the following statement which he makes in reference to cholera, that "microscopical studies have taught us absolutely nothing."

**THE COMMA BACILLUS.**—The question at issue is this: Is the doctrine true which assumes that the so-called comma bacillus is the essential cause of epidemic cholera?

Koch reports that it is present in all well-marked cases, that in one hundred examinations it was absent in none. The French commission refuse to accept Koch's conclusions;

although in twenty-four autopsies made by them a micro-organism was found in all but three cases, yet their report declares that they "do not feel authorized to attribute a specific action to the microbe which they found in great abundance in the majority of cases."

Koch not only found it present in well-marked cases of cholera, but found it absent in diseases other than cholera. Dr. Lewis, of the British army, who has studied cholera both in India and Marseilles, severely criticises Dr. Koch's report, and makes the statement that he has frequently found the comma bacillus in the salivary secretions of the mouths of healthy persons, but Koch shows that these are of a different form, and that they have been known for some years. Dr. Flint ("New York Medical Journal," October 25, 1884) adds this fact in support of Koch's view, that he is "not aware that in any instance as yet the presence of this parasite has been demonstrated by the culture-test except in cases of cholera. Obviously this test is essential in order to remove all doubt as to the accuracy of microscopical observations."

Not only is the cultivation-test considered important as bearing on the identity of the comma bacillus, but a still more deciding factor in the fate of this micro-organism is the test by inoculation. Whether the cholera-germ is inoculable or not is a feature of the researches so far involved in great uncertainty. Dr. Flint aptly says that "if, as in the case of the *Bacillus tuberculosis*, the parasite of cholera, after a series of cultivations, is capable of producing the disease by inoculation, the proof of its being the essential cause is absolute."

Besides the experiments of Koch, the two Swiss physicians sent out by the French Government report that they produced the disease in animals by inoculation. There are other experimenters who have reported the same success; but, from the fact that other equally eminent investigators have

obtained negative results, it must necessarily follow that the demonstration of the comma bacillus as the essential causative agent of cholera can not at present be received with universal satisfaction.

The severest blow, however, the comma bacillus has received is at the hands of the English commission. A preliminary report, given by Dr. Klein last November, briefly says this: That the comma bacilli are not characteristic of cholera, since they are present in diarrhoea and dysentery; that they behave precisely like other putrefactive organisms when cultivated artificially; and, finally, that all attempts made by the investigators to induce cholera in animals, by either feeding or inoculation with these germs, have signally failed.

It is reported that Dr. Klein has even shown his contempt for the microbe theory by swallowing a quantity of the bacilli without harmful result, but this freak is laughed at in Berlin by the friends of Koch, who assert that it proves nothing except that a suitable nidus is needed for the bacilli to develop in, as in other acute specific diseases, which Dr. Klein did not have.

Some French physician has also swallowed cholera matter in the form of a pill without bad results, but, when the same was given to dogs and guinea-pigs, death soon followed.

However, all these investigators seem to agree on one fact—that there is a specific cholera-germ, but that the comma bacillus is this germ all will not admit. This much is reasonably certain, that, whatever may be the fate of the comma bacillus, the tests by cultivation and inoculation will be the chief means of its final establishment or overthrow.

Bearing upon the general nature of the disease, the following points are interesting, as well as showing the chief characteristics of the infecting material:

1. The manner of transportation and diffusion of the cholera-germ.
2. The sudden onset of the disease and rapid prostration following.
3. Filth an essential factor.
4. Possibility of the disease being " stamped out."
5. Necessity of prompt treatment.

1. *Transportation and Diffusion.*—With reference to its transportation, Dr. Hamilton ("New York Medical Journal," Nov. 15, 1885) says that "the cholera-germ may be conveyed from place to place by clothing or by any other textural fabrics, by articles of food, by water, and by animate and inanimate substances. It may be conveyed for a considerable distance by the air. How far it can be thus conveyed it would be impossible to say, but probably much would depend upon the force of the wind and other atmospheric conditions. There is, no doubt, a limit to its conveyance by this method, and I have reason to believe that it can not be thus conveyed beyond a mile or two."

Dr. Leale, in a recent article on the study of Asiatic cholera ("New York Medical Journal," Jan. 3, 1885), makes the statement that "histories of past epidemics in this country clearly inform us that it enters, by commerce with infected ports, by either the contaminated clothing of passengers or polluted rags." The doctor adds that "newly manufactured woolen or other goods have never been the carriers of disease," but that "old rags and the wearing apparel of those from infected places are to be specially guarded."

That these germs are carried chiefly by means of wearing apparel and polluted rags there are many curious and perfect illustrations. The following are a few: Dr. Atlee, of Pennsylvania, in a report of cholera in 1873, states that "a car-load of emigrants came from Philadelphia to Columbia, Pa. Two or three of these emigrants, who were ill of

cholera, were put out on the platform at the railroad station. Some gentlemen, seeing them at the point of death, carried them to a shed and waited upon them. In forty-eight hours these emigrants and these gentlemen were dead, and the disease spread in the town."

An illustration of its extension by means of old clothing is given in a report by Dr. Leale of the entrance of cholera in the vicinity of 440 West Fifty-second Street, New York city, during 1866. "The person attacked was a driver, Peter Crow, on the Tenth Avenue cars, and while in perfect health at 4.30 p. m. Sunday, August 12th, he sat upon some baggage that had been carried on the front of the car by a party of five German emigrants who had just landed at Castle Garden. While sitting on their bundles of clothing, he states that he felt a peculiar chilly sensation, and that when he arrived at his home, seven hours afterward, at 11.30 p. m., he commenced to have nausea, vomiting, and purging, which were soon followed by severe and painful cramps." "Within twenty-four hours from the time he came in contact with the infected clothing he was in the profound collapse of the algid stage of cholera."

Another interesting example occurred at the close of the second great epidemic at Suspension Bridge, a small village twenty-two miles from Buffalo. Dr. R. J. Rogers, the only physician practicing there at that time, in a letter to Dr. Frank Hamilton, says that about the 15th of July, 1854, a company of German emigrants were dumped upon the banks of the river from the cars, awaiting transportation across the then unfinished bridge. Two or three cases of what were called cholera morbus were reported, and, on visiting them, he found unmistakable symptoms of Asiatic cholera. One of the men died in a few hours. The report goes on to say that the residents began to be attacked the following day.

Dr. J. H. Rauch, secretary of the Illinois State Board of Health, gives a striking instance of the portability of the infective agent of cholera. In an address before the National Conference of State Boards of Health in 1873, Dr. Rauch says that "there were outbreaks of epidemic cholera at Carthage, Ohio, Kandiyohi County, Minnesota, and Yankton, Dakota, caused by cholera poison packed up in the household effects of emigrants in Holland, Sweden, and Russia, respectively; these emigrants sailed from healthy ports, in healthy vessels, and were subjected to the usual sanitary requirements of the period. They passed through New York and all the intermediate territory without injury to the public health. But, when their infected goods were unpacked in the interior of the continent, they liberated the poison which gave rise to the local outbreaks."

These examples just related clearly confirm the manner in which the cholera-germ is usually carried; besides, they decidedly illustrate that this germ is long lived. It has been stated that this germ becomes inert in a very brief period, and that it is destroyed by desiccation; but surely these statements must be taken with a grain of allowance in the face of the foregoing facts.

2. *Sudden Onset and Rapid Prostration.*—That the onset of cholera is sudden and the prostration following rapid, goes without saying. The visitation of every epidemic exemplifies that fact. In the Peter Crow case, reported by Dr. Leale, it will be remembered that there was vomiting with purging seven hours after he was exposed to the bundle of rags on the street car, and within forty-eight hours his father and mother were stricken down with the disease.

Dr. Rogers, above quoted with reference to the Suspension Bridge scourge, says that "the visitation was remarkable for the suddenness of its appearance, its short duration,

the number of cases, and its terrible fatality." On the second day after the landing of the emigrants, a tramp, a ship-carpenter, and three laborers were attacked, and all died after a very brief illness. A few days later a number of laborers attended a wake of a patient who died of cholera, and, of those present at the wake, five died within twenty-four hours. Dr. Leale says that "the period of incubation is only of a few hours' duration, acting as rapidly as yeast acts upon dough." Dr. Rogers further makes the observation bearing upon the rapid and profound prostration following the attacks, that "one remarkable feature of the epidemic was that in a majority of the later cases there was an absence of the usual premonitory symptoms, many of the patients being in collapse within an hour. In the earlier cases, however, there was the usual vomiting, and then the rice-water discharges, accompanied with no pain usually, but with great lassitude and dejection, followed by cramps, confined mostly to the muscles and tendons of the toes, a gradual lowering of the temperature, profuse sweating and great thirst, the skin assuming a leaden color and losing its contractility, the pulse deserting the wrist, the tongue becoming cold, and the voice husky. As the period of unconsciousness approached, there would be restlessness, and, long after the cessation of the pulse, there would be considerable muscular activity. During the two or three most fatal days I would find the patients, within a few hours of the attack, with a cold tongue and pulseless, and with such a degree of hoarseness that they could only speak in a whisper, and still they could get up and walk about the room. Some had no vomiting or purging, and lived but a few hours."

3. *Filth an Essential Factor.*—Mr. John Simon, the chief medical officer of the English Privy Council, in a report to Parliament, says that "cholera derives all epidemic

destructiveness from filth, and especially from excremental uncleanness."

Dr. F. A. Burrall\* states that "the chosen haunts of cholera are in low, dark, damp, overcrowded dwellings, and among the ill-fed, badly clothed, filthy, and dissipated, where this disease makes its greatest ravages."

In addition to these conditions requisite to render the communication of cholera by the ordinary methods effective, Dr. Frank Hamilton mentions low lands and freshly exposed soil. With reference to the former he says: "If these lands are alluvial, and especially if underlaid with clay so as to retain moisture, they favor the propagation of cholera as well as of other diseases."

The report of the Registrar-General of England for 1848-'49 concludes with the statement that "the cholera rapidly diminishes a few feet above the low ground on a level with the Thames." It was during this same epidemic that the disease proved so terribly fatal at Toledo and Sandusky, Ohio, where in the latter city it is stated seventeen physicians died from the disease. Both these cities are located on low and exceedingly rich alluvial plains. During the Suspension Bridge epidemic referred to, Dr. Rogers states, "more than nine tenths of the victims resided on the narrow flats bordering the river on both sides," and, "of all the fatal cases, but five occurred in that portion of the village which was situated above these low plains."

As to the effect of the freshly exposed soil, the following, reported by Dr. Frank Hamilton, is interesting: "On Saturday, July 24, 1852, a ditch was commenced for the purpose of laying pipes through Ellicott Street, Buffalo. On Monday the work was renewed, and it was open completely on Tuesday. The excavation brought to the sur-

\* Burrall on "Cholera."

face a large amount of alluvium underlying made ground of clay and sand. The cholera was prevailing in a mild form in some other parts of the city, but Ellicott Street had always been regarded as healthy, and had almost entirely escaped in previous epidemics. It was occupied by the best class of citizens. There were twenty residences upon the portion of the street corresponding with the ditch. On Monday the first case of cholera occurred among the residents, and on this and the following days there were nineteen cases and nine deaths. The ditch was closed, by order of the Mayor, on Wednesday, and from this date there were no new cases of cholera."

Dr. Flint says, with reference to the influence of filth, that "some striking facts observed in India bearing on this point have been noted by Koch. It seems that in certain parts of India the water used in bathing, washing, cooking, and drinking is contained in tanks which are liable to become polluted by human excrement as well as by various kinds of filth. The occurrence of localized epidemics of cholera in the vicinity of these tanks had been a matter of frequent observation. Such a localized epidemic occurred during Koch's visit in India. About one hundred persons, living in huts situated in the vicinity of a tank, had been attacked with cholera. Examinations of the water in this tank showed the presence of the comma bacilli. The disappearance of these from the tank was coincident with the ending of the cholera epidemic. Examinations of water in other tanks were negative as regards the presence of these bacilli. That the water in the tanks gave rise to cholera had been previously the opinion of medical practitioners in India, and it had been observed that the substitution of pure water in certain situations had led to the disappearance of the disease."

At Suspension Bridge, Dr. Rogers says, "after the dis-

case began to subside, on examination, under the Bellevue House, a large amount of filth was found to have accumulated, and also stagnant water. There was no cellar. Two men brought from Lockport were employed to clean the premises and remove the filth, and both of them died in a day or two of cholera."

One would think it almost useless to multiply instances showing the part that filth occupies in the prevalence of cholera; but the examples given illustrate the fact so graphically that they easily bear repetition in emphasizing the prominence of this element in the study of the aetiology of this dread disease.

4. *Possibility of the Disease being "stamped out."*—Whether this disease can be kept away or checked, or made to disappear entirely, is a question for the most urgent consideration. That the disease is easily controlled and quickly yields to efficient sanitation, or, as it is tritely termed, the "stamping-out" process, there is abundant evidence to prove.

During the epidemic of 1866, at the Crow houses on West Fifty-second Street, cases continued to recur, even with the ordinary methods of disinfection and fumigation; but just as soon as Dr. E. B. Dalton, Sanitary Superintendent of the Board of Health, took it in hand, employing on a larger scale the most vigorous and effective methods, burning all suspicious articles, not a single case of cholera followed. In Dr. Dalton's report of the disease during the year 1866, during which time over one thousand deaths occurred in New York city, he makes the statement that "fumigation, either with chlorine or sulphurous-acid gas, has, with two exceptions, been followed by complete immunity from the disease."

The most striking illustration of the efficacy of the so-called "stamping-out" process is seen in a report given by

Dr. Frank Hamilton, who had complete control of the sanitary conditions of Blackwell's Island during the sudden and violent outbreak there in 1866. The following is, briefly, Dr. Hamilton's report: "On August 1st there were 29 new cases and 10 deaths; on August 2d there were 33 new cases and 14 deaths. On the next day (August 3d)," says Dr. Hamilton, "the most important sanitary changes had been made, some of which were very radical, and were in operation. On this day, August 3d, there were 30 new cases and 13 deaths; August 4th, 21 new cases and 4 deaths; August 5th, 12 new cases and 7 deaths; August 6th, 4 new cases and 3 deaths; August 7th, 1 new case and 1 death."

It will be seen, from this statement, that the epidemic began to decline from the day that the sanitary changes were enforced, and in four days—that is, on the 7th day of August—there was but one new case. Dr. Leroy M. Yale, one of the house staff there at that time, says, in a report, that on August 7th, the fourth day after the introduction of the rigid sanitary measures, "the epidemic was virtually at an end."

It is said that, in New York city, during the summer and autumn of 1866, cholera occurred in three hundred and sixty-two houses more or less widely separated from each other, and so completely was its diffusion checked that in no instance did the disease spread proximately beyond the house in which a case or cases occurred. Dr. Flint makes the assertion that "never before or since, in any other part of this or in any other country, have measures for the prevention of epidemics of cholera been devised so scientifically, so thoroughly carried out, nor so successful in the results as those employed by the New York Metropolitan Board of Health in 1866 and 1867. The fact should be cited everywhere as evidence that cholera is a disease

which may be stamped out by efficient sanitary measures efficiently employed."

5. *Necessity of Prompt Treatment.*—Aside from the immense practical importance of cholera prevention is the necessity of immediate treatment.

Cholera is classed, along with small-pox, measles, etc., as an infectious disease, the latter running a certain definite course, neither of them susceptible of being aborted. Not so, however, with cholera. It is the general belief that, if predisposing causes be removed and appropriate and immediate medication employed, perhaps a majority of cases will speedily recover.

But there must be no delay. Dr. Hamilton says that "it is not often that a patient is saved to whom remedies are not applied until the period of collapse has arrived; but a large proportion are saved by appropriate remedies employed in the earlier stages of the disease." Dr. Yale, in a report on cholera at Blackwell's Island, says that, of those brought first to the "diarrhoea hospital," not one died. The terrible fatality of the Suspension Bridge epidemic was no doubt due in a great measure to the fact that so many of the cases went into collapse so quickly, long before the arrival of the physician.

Dr. Flint, who has had extensive clinical observations in the treatment of cholera, says that "there is no disease with greater certainty controlled at the outset than this." In order to carry out these prompt measures, he maintains that "the only effectual plan is to organize a sanitary police, and provide for one or two domiciliary visits daily at every house within the limits of the epidemic, the purpose of the visits being to inquire if any one be affected with diarrhoea, to impress the importance of immediate attention to it, and, when circumstances render it necessary, to supply at once appropriate remedies. . . . Abundant proof of the success-

ful operation of the system of house-to-house visitation was furnished by its practical results in London and other towns in Great Britain during the epidemic of 1849."

As to medication, the list of remedies in fashion at the present day is not very long. Calomel has its advocates. Venesection has always had its friends and enemies. Even in the stage of collapse, where one would think blood-letting dangerous and where no one would seem to doubt the efficacy of external warmth and stimulants, it is asserted, on no less an authority than that of Dr. Parkes, who had a large clinical experience in India in 1843, that blood-letting and cold affusion were used with success in this stage, the embarrassed circulation being relieved and the respiration stimulated in the same manner that a new-born babe's respirations are quickened by the application of cold water.

There is one drug, however, concerning which there has been a great deal said, and that is opium. During the first stage, Dr. Flint says, in his recent article, "the controlling remedy *par excellence* is opium. Let opium, conjoined with rest of the body and of the digestive organs, be judiciously employed before the characteristic choleraic dejections occur, and the further development of the disease is prevented with almost absolute certainty. Let this treatment be promptly resorted to as soon as choleraic dejections have taken place, and, in a large proportion of cases, the disease is arrested."

This is putting the early treatment and its results in a nutshell. The positive manner in which it is expressed, coming from so eminent an authority, must necessarily carry great weight with it. If the statement be true, or even partially true, considering the fact that during the past century one million lives annually on an average have fallen victims to this terrible Oriental plague, the necessity for immediate medication becomes vastly more manifest and markedly em-

phasizes the immense responsibilities of those whose duty it is to care for the health of large municipalities.

The usefulness of opium in an epidemic of cholera morbus was seen a few years ago at Turk's Island, West Indies. The epidemic was attributable to impure water. The drinking-water there is rain-water collected from the roofs of houses into large tanks. When there was a scarcity of rain the water became quite low in the tanks, and consequently mixed with the sediment at the bottom. This epidemic lasted several weeks, and ended when plenty of rain filled the tanks with pure water. At this time there were nearly a hundred people stricken down, and the attacks of some were so sudden and severe that they had to be carried home. One grain of opium in pill was given hourly until relief was obtained, then given every two or three hours, as the case indicated. There was not one death during the entire epidemic, and all the cases yielded so readily to the drug that no other remedies were resorted to, except, however, in a few who were peculiarly susceptible to the effects of opium on the skin. In these cases large doses of astringents were used, but with apparently little effect, and, as in those cases that did not receive immediately the routine treatment, recovery seemed to follow much more slowly. In the few cases that were quite severe, where the stomach was not in a condition for the reception of medicine, morphine by the hypodermic needle was used with admirable results.

Now, assuming that, in the early stage, opium has a positive effect in controlling this disease, which we may grant for the present is due to some specific germ, it would be curious to know what the peculiar action of the drug is. Of course, whether the germ is narcotized or whether it is destroyed directly or indirectly by checking the alkalinity of the intestinal contents, is at present all speculation. Dr.

Hamilton says: "It is only necessary to suppose, what seems probable, that the period of life or activity of the germ in the human system is brief, and that opium holds the secretions in a normal condition until the germ perishes or the force of the virus is expended" ("New York Medical Journal," November 15, 1884).

In conclusion it may be stated:

1. That cholera occurs mainly in great epidemics, starting in India and moving in a westerly direction, reaching America usually about a year after its appearance in Europe.
2. That the fourth great epidemic has reached Europe.
3. That the identity of the comma bacillus as the causative agent of cholera is not as yet accepted by all scientific investigators.
4. That the manner of transportation and diffusion is generally by means of rags and polluted clothing, the latter being worn usually by emigrants.
5. That the incubation period is very short, the onset of the disease very sudden, and the prostration following quite rapid.
6. That filth in all its forms is a necessary concomitant to the disease. Filth may exist without cholera, but cholera seldom prevails without filth.
7. That the disease can be arrested and completely stamped out by efficient and vigorous sanitation, as has been demonstrated beyond all question.
8. That in addition to the extreme importance of efficient sanitation is the absolute necessity of the prompt attention to immediate treatment by the method of house-to-house visitation within the cholera limits, and, if need be, the instant removal of patients to hospital accommodations.

## PART II.\*

BY WILLIAM HENRY THAYER, M. D.,  
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To the report just presented by Dr. Baker I wish to add a few words on the pathology of cholera, with a brief review of the most approved methods of treatment; an outline of the epidemic of 1866 in Brooklyn and New York, with a description of the means employed to arrest it. I have taken the liberty to speak in the first person, as suited to the nature of my paper.

In a report of this kind, designed chiefly to initiate a discussion in the society bearing mainly on the subject of prevention and treatment of cholera, it is not desirable for me to devote much time to detailed description of the disease. It is enough to say, in the language of Dr. Parkes, who wrote in 1847, from five years' experience of cholera in India, that "it is primarily a disease of the blood; and the changes induced in the function of respiration, directly consequent on the alteration of the blood, are the proper and distinctive symptoms of the disease." The purging, vomiting, and cramps are speedily followed by the symptoms belonging to the circulation, that group of symptoms which marks the algid stage, "which afford the only measure of the severity of the case, and from them only can a correct prognosis be formed."

Dr. Parkes says: "The vast majority of untreated cases die."

The first indication, when the patient is seen at the outset, is to arrest purging. For this purpose absolute rest is

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required, with astringents and sedatives—such as acetate of lead with opium, or tannin, or the mixture prepared by Dr. Squibb, in 1866, of camphor, capsicum, chloroform, and opium.

But astringents and all other measures may fail to arrest the purging, and the algid symptoms begin to appear. "The list of remedies which have been used in cholera to counteract the deeper and more important changes in the blood comprises all the stronger medicines known to physicians at the present day," says Parkes, "and it appears to me," he continues, "no one medicine has been found more efficacious than another." The warm bath is injurious. Cold affusion is grateful, and sometimes temporarily beneficial. Stimulants are quite useless, and indeed hurtful. Venesection was much in favor with East India surgeons at one time, but in subsequent epidemics the results were unfavorable. Calomel, strychnine, sulphuric acid, chloroform, camphor, saline enemata, enemata of brandy and water, repeated doses of castor-oil, ice-bags to the spine—these are the remedies which have been used with more or less apparent success by different men in different epidemics.

My personal experience in 1849 and 1866 leads me to say that very little time should be spent in any attempt to arrest the diarrhea by astringents or kindred medicines. When the algid symptoms begin to appear, it is too late to cure the disease by stopping the diarrhea. Indeed, some observers believe it to be salutary. Every one who has had experience in cholera knows that the diarrhea is no index of the severity of the disease. The cases most rapidly fatal are those in which the evacuations are least. This fact gives color to the opinion held by some that the discharge from the bowels is the means of eliminating the choleraic poison.

In 1849 the experience of East India surgeons led me to bleed the patients. In a dispensary practice in which I saw

a number of cases there were some recoveries under venesection : in the case of one man, whose radial pulse was already entirely absent, and blood could for some minutes only be forced out drop by drop from the median basilic vein by continual "stripping" of the arm from the wrist to the elbow, I think it was a full half-hour before it flowed spontaneously. When this occurred, the skin began to grow warm and less livid, respiration became easier, and the patient went on to recovery. But there were others, whose condition seemed more hopeful when first seen than this man's, who were bled while there was a radial pulse, who did not for a moment improve under the venesection.

In 1866, when I had charge of the Hamilton Avenue Cholera Hospital, venesection was not employed there. After a trial for a few days of various remedies which had been most approved, all the cases not hopelessly advanced were treated with calomel, in doses of from three to ten grains, according to the age of the patients, repeated at hourly intervals till three or four were taken, or bilious dejections began. The results were gratifying. We had eighty-four patients with cholera, of whom twenty-six recovered and fifty-eight died. Thirteen only of these entered the hospital before the algid stage ; of these, twelve recovered ; they were treated with calomel from their entrance. The one who died had no calomel. Seven of the fifty-seven who entered in the stage of collapse recovered under the calomel treatment. The mortality is far greater than it would be if the patients came under treatment at the outset of the disease ; two thirds of these were already in the stage of collapse when they entered the hospital.

The general plan of treatment was absolute rest, no food while vomiting continued, ice or water in frequent small quantities, astringents and opiates if seen very early ; but if diarrhoea continued, or if there was the slightest hint of

algid symptoms, calomel in repeated doses until bilious evacuations were produced. After this, nourishment in small quantities. But this general plan was so far varied that, after the calomel treatment was adopted in the hospital, we never gave astringents or opiates, or took any direct method to arrest diarrhoea; all patients not hopelessly collapsed and past the power of absorbing medicines were put on calomel at once.

Emetics have been recommended to be given until vigorous emesis is produced, resulting sometimes in the discharge of undigested food long retained, which the involuntary vomiting of cholera had not dislodged. According to Dr. J. C. Hutchison, who had charge of the Brooklyn Cholera Hospital in 1854, after emesis produced in this way the choleraic vomiting usually stopped.

The calomel treatment was pursued in the four cholera hospitals of New York and Brooklyn in 1866, with about the same results in all. It met with favor in Europe and in the U. S. Army. The "Report on Cholera in 1867" in "Circular No. 1, Surgeon-General's Office, 1868," contains favorable testimony to its efficacy from many army surgeons. In 1854, Dr. Hutchison, who treated one hundred and forty-four cases in his hospital, made no attempt to check the diarrhoea, but gave one grain of calomel every hour; and all those who entered the hospital in the first stage recovered.

Nevertheless, an examination of cholera reports in several epidemics in Europe and India discovers nearly as favorable testimony of the use of some of the other remedies already enumerated; and shows that longer experience with any plan of treatment is needed to establish its value, and that remedies sometimes owe their apparent success to the mild character of the epidemic. The remedies thus far addressed to the algid stage of the disease have been em-

pirical. In the first stage there seems to be a clear indication to arrest diarrhoea. But the essential nature of the fully formed disease consists of material alterations in the blood; not merely in loss of serum—which is not so considerable as frequently takes place in “cholera morbus”—but in disorganization of the red corpuscles, by which its oxygenating power is lost or impaired. The blood is invariably deeply carbonized after the formation of the algid stage, and, on exposure to the air, is very slow to absorb oxygen. The expired air contains no trace of carbonic acid, and has an excess of oxygen—a condition fairly attributable to the abnormal condition of the red corpuscles. The patient dies asphyxiated. Whatever mode of treatment is to be beneficial after the disease is fairly established must include remedies which have an influence beyond checking the discharges; they must have the power of arresting the destruction of the red corpuscles, a result to be attained by staying the germination of the specific cause of cholera within the body. Now, has calomel the power to do this, and are there other medicines equally effectual?

Parkes says “the vast majority of untreated cases die.” But such a statement must be taken as referring to the Hindoo population, who sicken and die in their hovels in the concentrated choleraic poison arising from the saturated ground, not only refusing medical treatment, but neglecting all improvement of their unhealthy surroundings. Such an opinion may not be correctly given of persons at rest in a well-ventilated building, in a wholesome locality, carefully nursed, and, after these provisions, trusted to their natural restorative powers. There is probably a self-limitation in cholera, and, if the patient is not rapidly killed by the alterations of the blood, the system slowly recovers itself. This is still an open question. I am unable to produce any favorable reports of cases in which no medicine was administered;

unless we except the following statement of Dr. Hutchison in his report: "Whenever in any case we are at a loss to know what treatment to adopt, or if we find the patient growing worse under the influence of remedies that we think best adapted to the case, the better plan is to rely on the *vis medicatrix naturee*. This I have repeatedly done with much satisfaction, patients in the deepest collapse having reacted without any treatment—in one case without even ice, beef-tea, or external applications." But, according to Dr. Hutchison's report, patients received in the first stage were treated with repeated small doses of calomel, and all recovered.

The returns of the mortality from cholera in Brooklyn and New York in the various hospitals and public institutions, and in the community outside, are instructive as to the influence of their various circumstances upon the mortality, as will be seen by the following table:

	Cases.	Deaths.	Percentage of deaths.
Brooklyn Cholera Hospital, 1854.....	144	88	61
Brooklyn, Hamilton Ave. Hospital, 1866 ...	84	58	69
"      City Park Hospital, 1866 .....	18	11	61
Kings County Penitentiary, 1866 .....	87	67	77
Brooklyn cases, outside hospitals, 1866....	572	408	71
New York Red House Hospital, 1866.....	50	33	66
"      Battery Hospital, 1866.....	149	107	72
Blackwell's Island Lunatic Asylum, 1866...	98	62	63
"      Workhouse, 1866.....	204	147	72+
"      Almshouse, 1866.....	111	90	81
"      Charity Hospital, 1866 ..	50	42	84
"      Penitentiary, 1866.....	19	7	36

By this table it will be seen that in cholera hospitals the percentage of deaths ranged from 61 to 72, averaging 65½, nearly 66, while the percentage of deaths in Brooklyn outside of hospitals was 71. A large majority of the hospital patients were in the algid stage on admission, and some of

them moribund; but most of those who were still amenable to treatment recovered, who, under their average circumstances in tenement-houses, would have died.

The returns from the penitentiary on Blackwell's Island probably give a fair showing of the results of cases placed in the most favorable circumstances: nineteen cases and seven deaths = 36 per cent. The subjects averaged twenty-seven years of age, were probably generally vigorous and were where they came under treatment at once and were not removed. Hospital patients, on the other hand, are aggravated by transportation when they need absolute rest, and have been ill for hours when put under treatment.

The workhouse had 72 per cent. of deaths, the patients being older and less vigorous; the almshouse 81 per cent., the patients being still older and generally broken down; and the Charity Hospital 84 per cent., the inmates being already diseased.

I suppose it may be maintained as an undisputed fact that cholera is extended from the subject to other persons by the evacuations only. Further time is required to settle the question whether the comma bacillus is the essential germ of the disease. But this is immaterial while we know that the evacuations contain the poison, and all of it. This places the extension of cholera within our control. The history of the epidemic of 1866 affords many instances of the possibility of arresting the epidemic promptly by suitable disinfection. It is not possible always to trace the cases to their source of infection. Thus, in Brooklyn the first case was in Walcott Street, Twelfth Ward, July 7th. Other cases occurred within the next four days in the Third, Fourth, Sixth, Ninth, Twelfth, Seventeenth, and Nineteenth Wards, points widely distant from each other. In New York three cases occurred in the first week of May, the third case being five miles from the others. There was no

evidence of the source of infection in any of them. Thorough disinfection of the premises was made, and no other case was seen in New York for a month.

In these two cities, cholera was confined almost exclusively to tenement-houses, or such places as the miscellaneous filthy hovels on the wet and foul soil of the Twelfth Ward of Brooklyn, or institutions where many persons were crowded together. And the experience has been the same everywhere. The cholera poison does not easily germinate or develop in clean places. It requires moisture and filth. In the four cholera hospitals of Brooklyn and New York no case occurred among the attendants, who were numerous and passed their whole time in the buildings.

The chief means of arresting the epidemic are ventilation of houses and chemical destruction of the excreta. In 1849 it was not yet known or suspected that the epidemic was to be arrested by disinfection of the excreta, and no attention was paid to them; nevertheless, there were many single cases of cholera in private houses, where there was nothing to prevent its extension but cleanliness and good ventilation. And even in a public institution in Boston—a temporary home for destitute children—which had perhaps thirty inmates, the matron died under my care after nine hours' illness, and was buried from there two or three days later, yet no other case occurred in the house. At that time, therefore, cleanliness and ventilation were all that aided its own limitations in checking the spread of cholera. It was regarded as an epidemic whose extension was due to atmospheric conditions unknown and uncontrollable.

At present, it having been demonstrated that the excreta carry the poison, which may be transmitted from the sick to the well through drinking-water which it has contaminated, or through the air of confined apartments which it has infected, the indications are clearly for the chemical de-

struction of all discharges and the thorough purification of the clothing and bedding of the sick, and a provision for water for household uses from sources entirely beyond possibility of contamination by cholera poison. In the matter of drinking-water, Brooklyn is safe, for the Health Commissioner has at last succeeded in having every well within the city limits filled up, so that the whole water supply now comes from Hempstead, some miles in the country. All that remains, therefore, is to destroy the excreta. If this is thoroughly done, no disinfection of houses after the death or removal of cholera patients—by steam, sulphurous-acid gas, chlorine, or any other method—can be necessary, because no germs or cholera poison will have escaped into the air, or, if escaped, will have been retained within doors if the building has been constantly and thoroughly ventilated.

To disinfect the excreta we may employ bichloride of mercury or chloride of lime, either one of which is deemed effectual by the Committee on Disinfectants of the American Public Health Association. They advise chloride of lime dissolved in water, in the proportion of four ounces to the gallon of water—one pint of this solution to be added to each discharge in cholera, to be left in the vessel ten minutes before it is emptied into the water-closet; or corrosive sublimate and permanganate of potash, dissolved in soft water, two drachms of each salt to the gallon. This is equally effective, and has the advantage of being inodorous, but the discharge requires to stand in the vessel an hour after the solution is added before being emptied into the water-closet.

The Committee of the Public Health Association assert that sulphate of iron is not a germicide, but valuable as an antiseptic, "its low price making it one of the most valuable agents for the arrest of putrefactive decomposition in

privy vaults." That it exercises a restraining influence upon the development of disease-germs can hardly be questioned when we consider what good results followed its use in 1866. In the Hamilton Avenue Hospital it was systematically added to every dejection; and if it is inert, then we must believe that the most complete ventilation is an all-sufficient disinfectant. The hospital occupied one floor of a building measuring seventy by one hundred and ten feet, high-studded, with all its many windows and three large doors constantly open, through which there was a fresh breeze blowing most of the time. The other three hospitals in the Metropolitan Sanitary District used sulphate of iron as a disinfectant in the same way, and no case of cholera originated in any one of them.

"In the New York hospitals of the Health Department all bedding and clothing soiled or used by the patient was boiled in a solution of permanganate of potassium for two hours, and then removed and boiled in pure water. Chloride of lime, or Labarraque's solution of chlorinated soda, was scattered freely about the floors." In the Hamilton Avenue Hospital the floors were scrubbed with soap and water; the blankets and other clothing, after removal from a patient, were immersed in a barrel of water to which a pint of Labarraque's solution had been added, and, after remaining there twenty-four hours, were boiled and washed. One woman washed these clothes for five weeks. Mattresses and pillows were thoroughly aired; if wet, they were burned.

There were several striking instances during the epidemic of 1866 of its prompt arrest in public institutions by dispersion of the inmates and thorough disinfection. A notable one is that of the workhouse on Blackwell's Island, where, under the direction of Professor Frank H. Hamilton, the inmates were distributed as far as the vacant

places in the building would permit, disinfectants were thoroughly used, the diet was improved, and every possible step was taken for cleanliness and the chemical destruction of the excreta. The epidemic began to decline from the day these measures were fully carried out, and in five days it ceased entirely. It lasted nine days, during which time 123 of the 800 inmates died.

At the Kings County Penitentiary, which had eighty-seven cases, all the inmates who were well were removed to tents outside the prison on the 5th of August. Only six cases occurred after removal to the tents, and three of these were in attendants, who continued to sleep in the prison.

The cholera poison does not spread far from its source Lebert says: "According to the most recent investigations, it is well established that cholera is as old as the human race in India, and that the mouths of the Ganges and Brahmaputra are to-day, as they have been from time immemorial, the centers of departure of the great Indian epidemics of this disease" (Ziemssen, i, 353). Parkes, speaking of the disease at Moulmein, in Burmah, says: "For many months it was confined almost entirely to the houses situated on or over the river, and chiefly to the south end of the town. One side of the main street runs close to the river, and the great majority of cases occurred on this side." "The only Europeans attacked at the commencement of the epidemic were the sailors belonging to the ships in the river; the ships nearest the shore suffered most. Thus nine cases occurred on board H. M. brig Britomarte, lying close in shore; she was moved about a mile away, into the center of the stream, and no more cases occurred." "No case occurred in the European and native regiments, whose barracks are situated half a mile from the river, although these men were allowed unrestricted intercourse with the bazaar."

In several European steamers that arrived with cholera on board during the spring of 1866 the disease was confined to the steerage, where it originated, no case occurring in the cabin. On board the steamer England there were two hundred and fifty deaths by cholera during the voyage, but no cabin passenger was ill. The same is true of the Virginia, which arrived on the 18th of April; no cabin passenger was affected. In Brooklyn, in the Twelfth Ward, where nearly half the cases occurred, the disease clung especially to certain houses, situated nowise worse than many others, and peculiar only in having cholera cases already there. It is difficult to understand its spreading around the world at long intervals only, rather than prevailing every year wherever a suitable nidus can be found, without admitting some other means of transmission besides personal contamination. But this is the only means of extension thus far demonstrated; and we find it possible to check its extension as soon as discovered.

By far the most important consideration is the removal, before the invasion of the epidemic, of all media for the development of cholera-germs in the soil, or the air of houses and localities, by measures of general and local purification, and especially by complete sewerage of every inhabited district, and by every possible provision against crowding and the faulty construction of houses.

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